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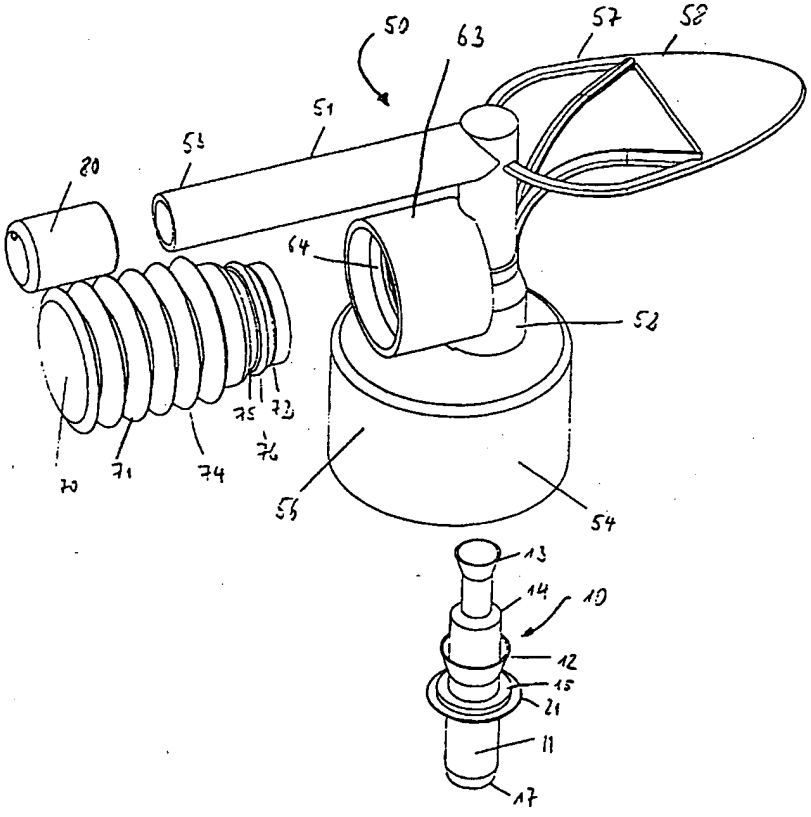
(54) Title: PUMP DEVICES FOR LIQUID PRODUCTS



(57) Abstract: A liquid spray device (50), such as that used for dispensing household cleaning materials, comprising a body, with a flow path defined therein, a valve member (10), allowing flow to pass in one direction but preventing flow in the reverse direction, and a pump (75) for controlling the flow of liquid through the flow path. The pump comprises manually operable bellows (74), which serve both as an actuator and a pump chamber. The bellows are arranged so that they can be pressed by the finger of a user and then return to their normal expanded configuration on removal of the pressure. This arrangement removes the need for a separate actuator (normally provided by a trigger), thereby reducing the number of components which have to be assembled.

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PUMP DEVICES FOR LIQUID PRODUCTS

The present invention relates to pump devices for dispensing liquid products such as household cleaning liquids and in particular a pump actuator and inversion feature for such a pump device.

Liquid spray devices normally comprise a container for a liquid, such as a cleaning agent, and a pump device which is screwed onto the container. The pump device comprises a trigger by means of which the user, (by generating a substmospheric pressure) draws the cleaning agent into a pump chamber. The liquid is then expelled from the pump chamber through a nozzle, under pressure generated by the trigger mechanism. For this purpose, the pump device comprises suitable valves in order to allow the cleaning agent to flow from the container to the nozzle but not in the reverse direction. Thus, cleaning agent is drawn from the container and forced out through the nozzle in response to alternate induction and discharge operations of the pump.

It is the object of the present invention to reduce the number of components required to produce a liquid spray device to a minimum and thus the costs for producing and assembling the components using automated, high speed production. The present invention was conceived with low cost production in mind and provides, in accordance with a first embodiment, a pump device having a conduit, and a pump. The conduit extends from a first end (neighbouring the liquid container) to a second end to which a nozzle (made of PP for example) is attached. Preferably, the conduit is L-shaped.

Moreover, the pump device according to the present invention comprises a pump mounting means in fluid communication with the conduit. The pump mounting means is realised such that the pump may be connected to the conduit.

The conduit comprises at least one radial port, in the area of the mounting means, to provide fluid communication between the pump chamber and the conduit. Preferably, at least two ports are provided in the axial direction of the conduit, an inlet port and an outlet port.

The mounting means for the pump preferably comprises an essentially cylindrical collar, extending perpendicularly to the axis of the conduit. On its interior, this collar has a peripheral bead or projections spaced in the circumferential direction, in order to provide snap-engagement with the pump. Preferably, a spacer is also provided within the collar. The spacer may be cylindrical or may be realised as annularly arranged pins. The spacer serves for limiting the compression stroke of the pump.

The pump according to the invention comprises a pump chamber, which may be elastomeric, arranged for finger actuation by the user, no separate trigger being provided. The pump chamber may be corrugated to assist expansion and contraction for pumping, and the corrugations may be separate or they may take the form of a continuous helical thread. Therefore, the pump may take the form of a manually operable bellows providing both a pump chamber and actuation means.

Preferably, the conduit, pump mounting means, and the pump, e.g. the manually-operable bellows, are formed integrally. The pump preferably comprises a pumping region and a mounting region. The mounting region is preferably cylindrical and comprises a circumferential groove (on its outer surface) for snap-engagement with the bead or the projections of the pump mounting means. Preferably, a peripheral sealing lip is also provided which, in the mounted state, seals the mounting region of the pump against the pump mounting means. The pumping portion preferably takes the form of bellows, is preferably cylindrical and comprises a plurality of parallel folds. In an alternative embodiment the pumping portion takes the form of a helical thread. This embodiment is particularly suitable for producing the bellows integrally with the pump device, since removal of the bellows section from the mould is possible by a screw movement. In a further alternative embodiment, the bellows shaped pumping portion comprises folds arranged like a fan. The folds allow the bellows sections to be compressed, for instance by the forefinger of a user. The inherent elasticity of the bellows construction and the material used is sufficient to cause the bellows section to return to its original shape when the pressure upon it is relaxed. In this way, upon exertion of a pressure against the bellows, liquid is dispensed from the pump chamber, and when the bellows returns to its original position, liquid is drawn into the pump chamber. The bellows section is preferably made of PP.

In a preferred embodiment, the pump device according to the present invention comprises an overcap which covers the bellows before use and this can act as a tamper evidence feature. The overcap may also be used to prevent accidental actuation of the pump device.

The liquid spray device also comprises a coupling means to connect the device to a container of liquid. This coupling means is preferably realised as a screw connection, snap engagement or bayonet connection. The coupling means preferably comprises a vent opening adjacent to the conduit to allow air to flow into the interior of the container as product is dispensed.

A shroud is provided on the side of the pump device opposite the nozzle. Said shroud rests on the users hand between the thumb and forefinger during use of the liquid spray device. The shroud is preferably open towards the top so that a mould core can be inserted. However, during mounting of the shroud on the pump spray, this opening is preferably closed by a cover plate. Alternatively, the shroud may comprise a hand rest area connected with the pump device via struts.

The pump device according to the present invention may be moulded in one piece by injection moulding, preferably including the pump. In this way, only the valve element and a spray nozzle need to be inserted or attached, respectively, before assembly of the pump device onto a liquid container. This allows production at considerably lower costs, since the number of individual components is reduced compared to conventional liquid spray devices. Furthermore, due to the smaller

number of individual components simpler and faster assembly is possible. Preferably, all parts of the pump device are made of polypropylene (PP) or polyethylene (PE). This design is therefore cost-efficient and can be used, in particular, for dispensing liquids such as bleaches or petrol-based products.

The present invention also proposes an inversion feature, which allows the liquid spray device to operate, even when it is held in an inverted position. This inversion feature may be used on its own or in combination with the pump arrangement described above. Conventional spray devices have a diptube, which extends to the bottom end of an associated liquid container. The liquid product may thus be drawn from said bottom end of the container when the spray device is held in a normal, upright orientation.

The inversion feature according to the present invention comprises a conventional dip tube, but also a shorter auxiliary conduit arranged to communicate with the end of the container opposite the said normal bottom end thereof. Thus, the auxiliary conduit is arranged to communicate with the liquid product when the container is held in an inverted orientation.

Thus the dip tube arrangement according to the invention comprises an outlet port, for connection to a liquid spray device, a first inlet part providing the liquid product intake when the container is inverted, (i.e. the inlet to the auxiliary conduit) and a second inlet port, providing the liquid product intake when the container is held in its normal, upright orientation

(i.e. the inlet to the diptube). The auxiliary conduit has a valve which closes the first inlet port when the container is held in its normal, upright orientation, thus preventing air from being drawn into the spray device. However, when the container is inverted, the valve opens, allowing product to flow through the auxiliary conduit. The inversion feature is characterised in that the diptube has no valve at its free end, but the auxiliary conduit is so dimensioned relative to the diptube, that during inverted operation substantially no air is drawn through the diptube from the container headspace. The auxiliary conduit must be of sufficient diameter to ensure that the volume of liquid drawn into the pump chamber during the induction stroke can be supplied from the auxiliary conduit, thereby preventing air being drawn from the headspace, through the diptube and into the pump chamber. A dynamic equilibrium is thereby set up between the fluid in the diptube and the auxiliary conduit.

Preferably, the first inlet port comprises a cage in which a ball is arranged. The ball may be made of plastic or metal. The cage and the ball are shaped and arranged such that the ball closes the inlet portion in a first position of the inversion feature, corresponding to the normal, upright position of the liquid spray device. In this position, liquid is drawn into the pump device through the diptube. In a second position, corresponding to an inverted orientation of the liquid spray device the ball opens the first inlet port. The free end of the diptube is as a rule no longer covered with liquid. The

first inlet port, however, is covered with liquid and liquid is drawn in through the first inlet port. According to the invention, the relationship between the cross-section of the first inlet port, adjacent to the ball and the cross-section of the second inlet port (or diptube) is such that during intake of liquid in the inverted position, the liquid is mainly drawn in through the first inlet port only and the liquid level in the second inlet port (or the diptube) is essentially maintained. Preferably, the cross-section of the first inlet port adjacent to the ball is essentially the same or larger than the cross-section of the second inlet port. The liquid circulation in the inverted position is therefore controlled dynamically, in such a way that the liquid level in the diptube does not drop to the connection and thus no air can enter the pump chamber.

The cage preferably comprises a plurality of spring elements extending axially and having projections pointing inwardly. These projections allow the ball to be inserted into the cage but prevent it from falling out, when the spray device is inverted. In the inverted position, in which the ball does not close the inlet port but lies in the cage at a distance from the port, liquid can be drawn into the auxiliary conduit through the slots between the spring elements.

The inversion feature according to the invention is preferably made of polypropylene. The diptube can alternatively be made of polypropylene or polyethylene.

These and other aspects and features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig.1 is an exploded view of the pump device according to a first embodiment of the present invention;

Fig.2 is a sectional view of the pump device shown in Fig.1;

Fig.3 is a sectional view of a pump device according to a second embodiment of the invention with the pump taking the form of fan-shaped bellows.

Fig.4 is a sectional view of a pump device according to the present invention with an alternative fan shaped, bellows arrangement.

Fig.5 is an exploded view of a pump device according to a fourth embodiment of the present invention having a pump chamber taking a helical thread form and including an inverting valve according to the invention.

Fig.6 is a sectional view of the pump device according to Fig.6 with helical thread form pump chamber and inverting valve;

Figs. 7 to 10 are perspective and section views of different bellows configurations.

Referring to Figs.1 and 2, a pump device 50 according to the invention comprises an L-shaped conduit 51 and a pump 71. The conduit has a first end 52 having a cap 54 for connecting the pump device 50 to a container of liquid (not shown). A vent opening 56 is provided in the cap 54 to allow air to enter the liquid container as

product is dispensed. The conduit also has a second end 53, to which a nozzle 80 may be attached. Adjacent to the first end 52 of the conduit 51, a cylindrical collar 63 is provided, perpendicular to the axis of the conduit 51. The collar 63 provides the mounting means for the pump 71. The pump 71 has a flexible pumping section 70 and a rigid mounting section 72. The pumping section 70 takes the form of bellows, having a plurality of folds 74 arranged in parallel planes. The mounting portion 72 is intended to connect the pump 71 to the mounting collar 63. For this purpose, the mounting portion 72 of the pump is provided with a groove 75, which extends in a circumferential direction. The mounting collar 63 has an internal peripheral bead 64, which is adapted to snap into the groove 75 to secure the pump 71 to the conduit 51. A peripheral sealing lip or sealing flange 76 is provided for sealing the connection between the pump 71 and the collar 63. A hand rest area 58 is attached to the conduit 51 (opposite the collar 63) by means of struts 67.

To assemble the pump device 50, the pump 71 is snap engaged in the collar 63, the nozzle 80 is push fitted over the second end 53 of the conduit 51 and a valve element 10 is inserted from the first end 52 of the conduit 51. The valve element 10 comprises a cylindrical body 11 having a step 14 which is intended to abut against a corresponding shoulder inside the conduit 51. Preferably, the step 14 also serves to seal the conduit 51.

The valve element 10 has an outlet valve 13, realised as a resilient flange and provided at the downstream end of the valve element. An inlet valve 12, also realised as a resilient flange, is provided at the upstream end of the valve element 10.

Both valves 12, 13 are realised as frustoconical flanges, being inclined towards the outside in the flow direction. Further upstream, the valve element 10 has a seal 15 and an air valve 21. The air valve 21 covers the vent opening 56 in the assembled state. A diptube 37 may be attached to the mounting portion 17 of the valve element 10.

During operation of the pump device 50, upon return of the bellows from the compressed state to its original, relaxed state, liquid is drawn through the diptube (not shown) and into the valve element 10. The liquid flows through a radial opening 16 into a space between the seal 15 and inlet valve 12. The liquid flowing out of the radial opening 16, passes the inlet valve 12 and flows via an inlet port 62, into the pump chamber, formed within the bellows 70. At the same time, the outlet valve 13 prevents liquid or air from being drawn from the downstream end 53 of the conduit 51 through the outlet port 61 into the bellows 70. When liquid is dispensed, by compressing the bellows 70 with a forefinger, liquid flows from the pump chamber (within the bellows), through the outlet port 61, past the outlet valve 13, to the nozzle 80. At the same time, the inlet valve 12, prevents the liquid from flowing back into the liquid container.

Fig.3 shows a second embodiment of the pump device 50 according to the present invention with valve element 10 and bellows 70. In this embodiment the hand rest area 58 is not attached via struts as in the first embodiment but extends from the cap 54 backwards and upwards to a continuous surface. Towards the top the hand rest area is open so that the mould core, which is inside during injection moulding, can be removed. The embodiment shown in Fig.3 differs from the embodiment according to Figs. 1 and 2 in that the pump is realised as a bellows 70 whose folds 74" are shaped like a fan. These fan-shaped folds are compressed such that the lower end of the bellows forms a pivot. Fig.3 shows the pump portion 73 and the mounting portion 72 of the bellows. The bellows is snap-engaged with the collar 63 by means of the mounting portion 72. For this purpose, the bead 64 engages in the groove 75. A spacing means (realised as a collar 65) is provided coaxially with respect to the collar 63 for sealing the bellows against the mounting collar 63. This collar presses the outer end of the mounting portion 72 towards the collar 63, so that the sealing lip 76 of the bellows seals against the collar 63.

Fig.4 shows a similar pump device to that shown in Fig.3. In this embodiment too, the bellows 70 has fan-shaped folds 74" which, however, are compressed such that the upper end of the bellows forms the pivot.

Figs.5 & 6 show a pump device according to a third embodiment. In this embodiment the bellows has a helical fold 74' and is formed integrally with the remaining components; conduit 51, pump mounting means 63 and cap

54. The opening in the bellows 70 (necessary for moulding and removing from the mould) is closed by a sealing plate 78. In this embodiment, a cap 77 is attached over the bellows.

In addition to the mentioned pump device, Figs.5 & 6 show an inversion feature 30 according to the present invention. The inversion feature may also be used in other pump devices, in particular in the above described first and second embodiments. The inversion feature 30 comprises a tubular outlet portion 31 and a first inlet portion 32 arranged parallel thereto. Outlet portion 31 and first inlet portion 32 are connected with a tubular second inlet portion 34 via a Y-connection or T-connection 33. In this embodiment, a diptube 37 is connected to the second inlet portion 34. At its free end, the first inlet portion 32 comprises a cage 35 which houses a freely movable ball 36. The ball is intended to close the inlet when it lies on the sealing surface as shown in Fig.6. The cage 35 is formed by axial spring elements 37 which each have one projection 39 at their ends. The slots 38 between the spring elements 37 allow the liquid to flow in when the liquid spray device is in an inverted position and the ball is not in contact with the sealing surface. The inversion feature according to the present invention renders a further valve along the length of the diptube 37 superfluous. For this purpose, the first inlet portion 32 is dimensioned (in relation to the second inlet portion 34 with diptube 37) such that essentially no air is drawn in from the headspace in the

liquid container when the liquid spray device is held upside-down.

A cover or a covering plate 59 is provided for the opening in the hand rest area 58.

Fig.6 shows a section through the embodiment according to Fig.5, in its assembled state. Since in this embodiment the bellows is integral with the remaining components of the pump device, a spacing means 65' is realised as a cylindrical collar extending into the interior of the bellows.

Figs. 7 to 10 show two further bellows arrangements in perspective and sectional views. The bellows have circular folds in parallel planes. However, the bellows are frustoconical so that the diameter of the folds increases in the longutidinal direction of the bellows.

CLAIMS:

1. A spray pump adapted to be fitted to a container, the spray pump comprising:
a body, defining a flow path from the container to an outlet nozzle,
a pump, for drawing fluid through the flow path from the container and for discharging it from the nozzle,
an actuator to allow a user to operate the pump, and
a valve element located in the flow path and adapted to control product flow through it, in response to alternate induction and discharge operations of the pump,
characterised in that
the pump includes a manually operable bellows, the bellows providing the actuator, arranged to be pressed by the finger of a user, and also defining the pump chamber.

2. A spray pump according to claim 1, wherein the manually operable bellows are formed integrally with the body.

3. A spray pump according to claim 1, wherein the manually operable bellows comprise a flexible, elastic pump portion and a mounting portion adapted to cooperate with corresponding mounting means on the body.

4. A spray pump according to claim 3, wherein the manually operable bellows has a pump portion comprising a plurality of circular peripheral folds arranged in parallel planes.

5. A spray pump according to claim 3, wherein the manually operable bellows have a pump portion, comprising a continuous helical fold.

6. A spray pump according to claim 3, wherein the manually operable bellows have a pump portion, comprising a plurality of folds arranged like a fan.

7. A spray pump adapted to be fitted to a container, the spray pump comprising:
a body, defining a flow path from the container to an outlet nozzle;
a pump for drawing fluid through the flow path from the container and for discharging it from the nozzle;
an actuator to allow a user to operate the pump;
a valve element located in the flow path and adapted to control product flow through it, in response to alternate induction and discharge operations of the pump and
an inversion feature, having a diptube arranged to extend to the bottom of the container;
and an auxiliary conduit in fluid communication with the diptube and having a valve which closes it against product flow except when the container is inverted, characterised in that
the auxiliary conduit is so dimensioned that during inverted, operation of the spray pump, substantially no air is drawn through the diptube from the container headspace.

8. A spray pump according to claim 7, wherein the valve in the auxiliary conduit comprises a ball, which seals against a valve seat when the spray pump is in an upright orientation, but which is free to fall clear of the valve seat when the spray pump is inverted, allowing liquid to flow into the auxiliary conduit.

9. A spray pump according to claim 8, wherein the ball is constrained to move within a cage having apertures, which allow the liquid to flow past the ball, when the spray pump is inverted and the ball lies clear of the valve seat.

10. A spray pump according to any one of claims 7 to 9, wherein the diameter auxiliary conduit is equal to or larger than the diameter of the diptube.

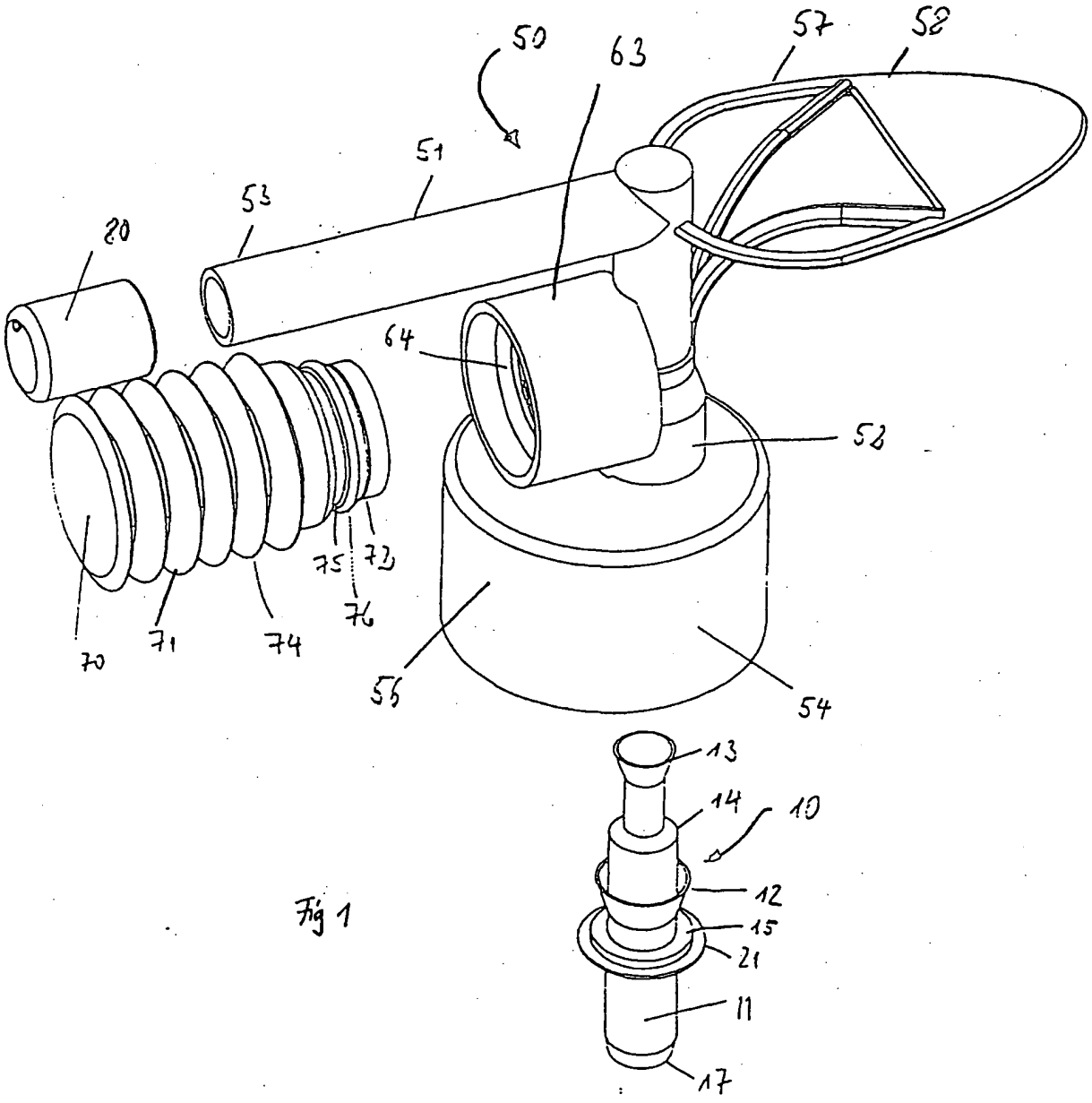
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Fig 1

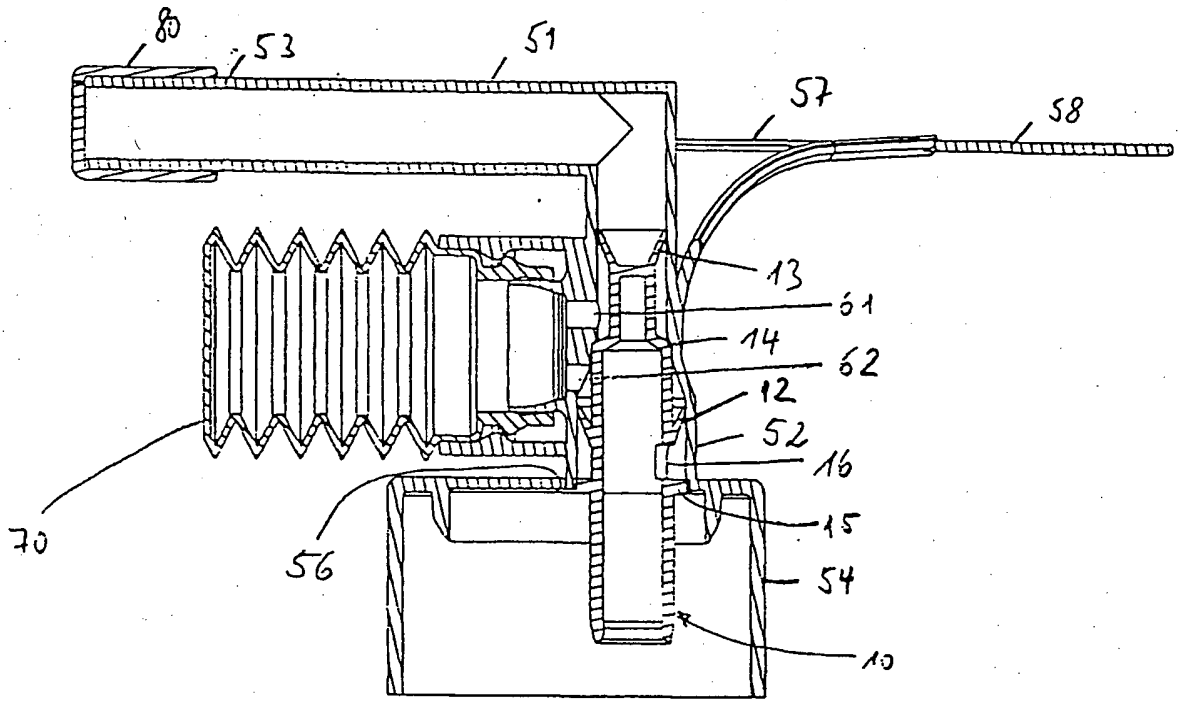

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Fig. 2

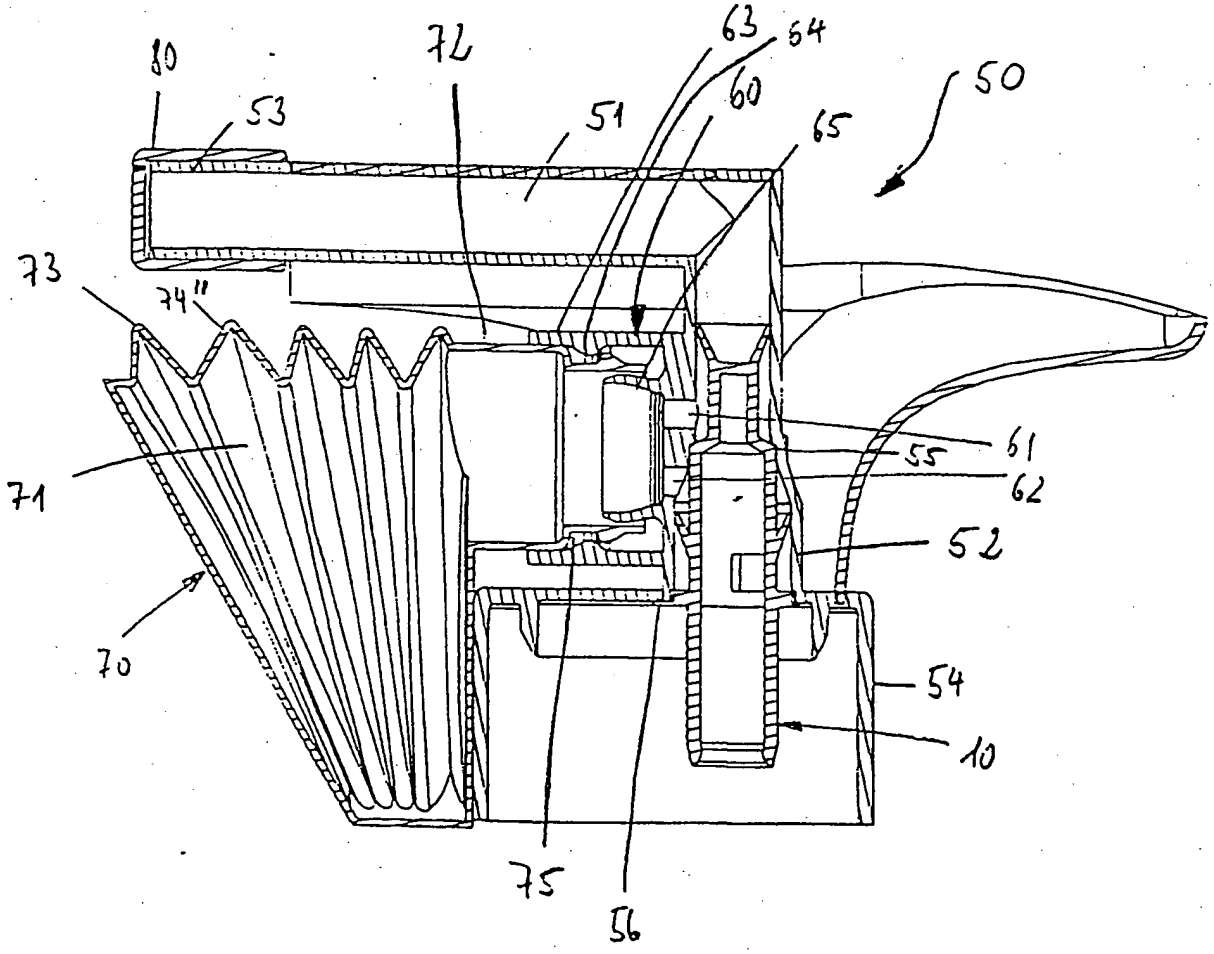

Fig. 3

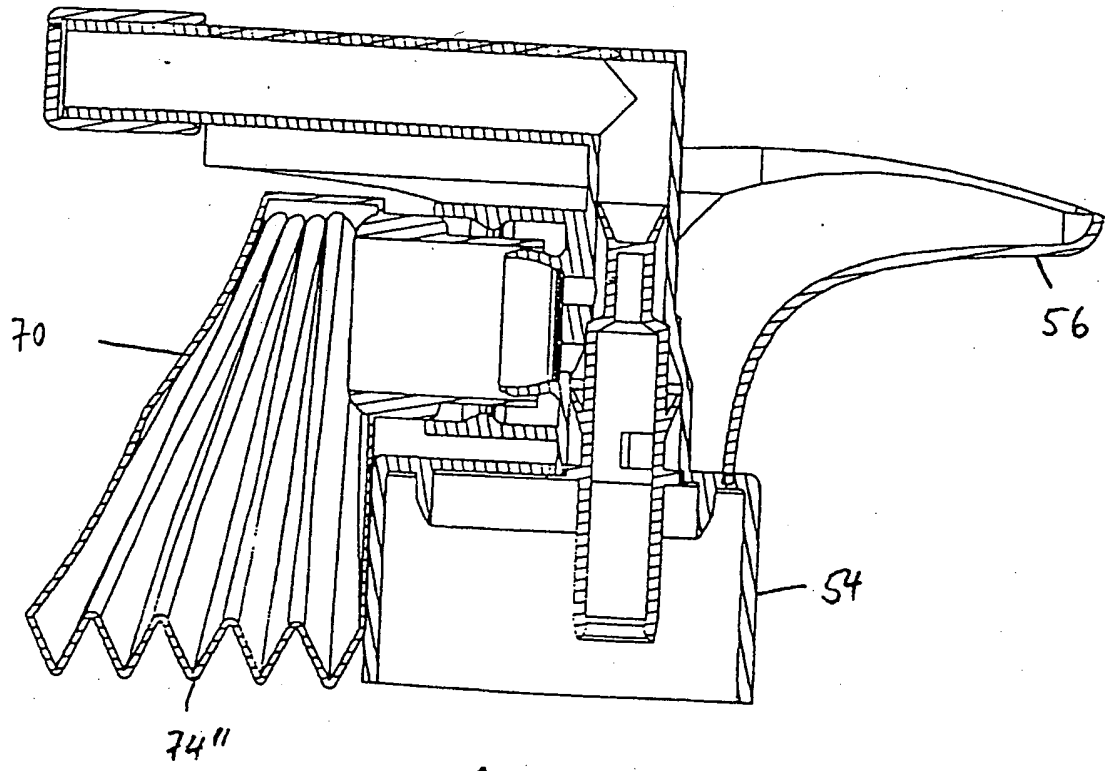

Fig. 4

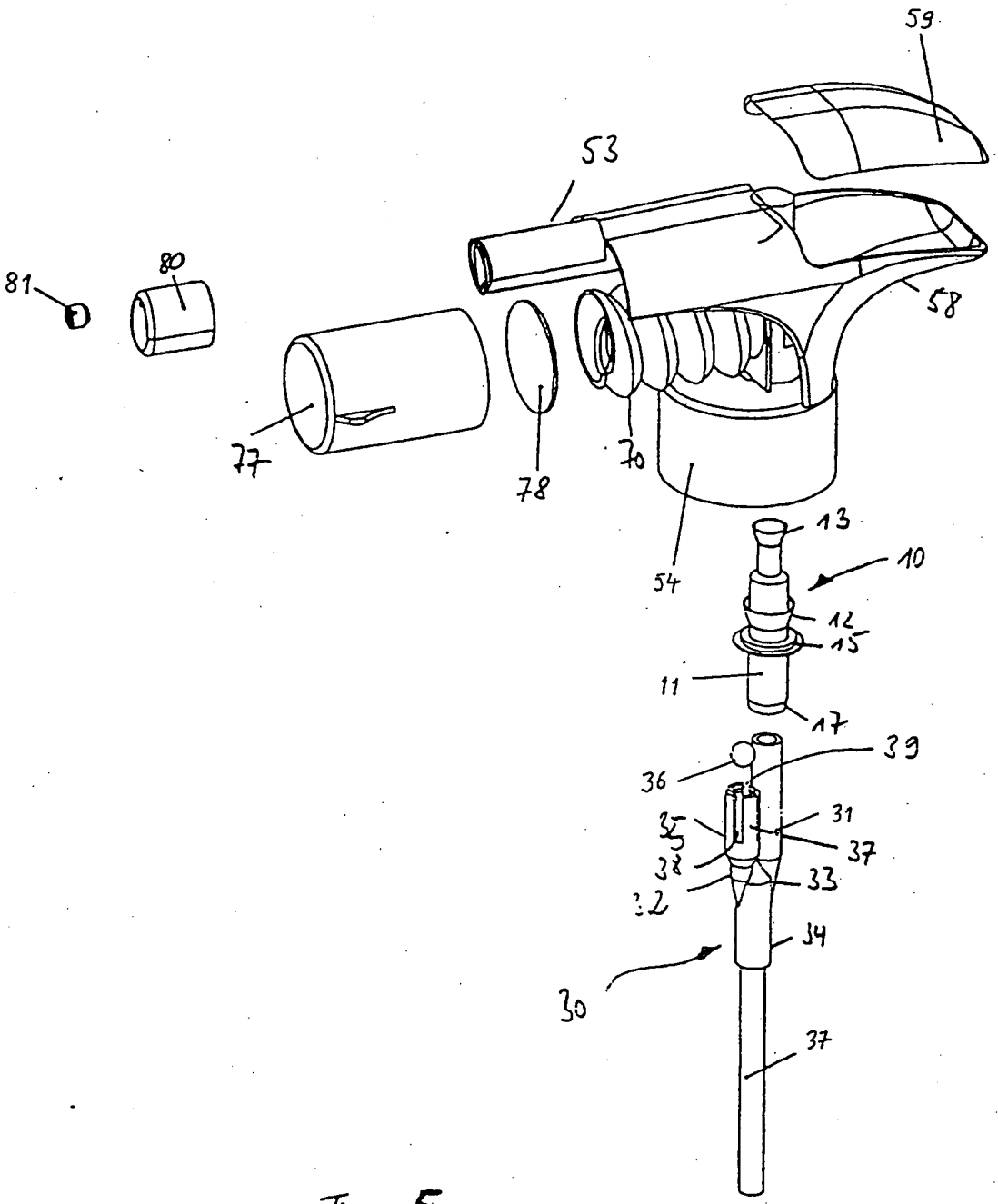
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Fig. 5

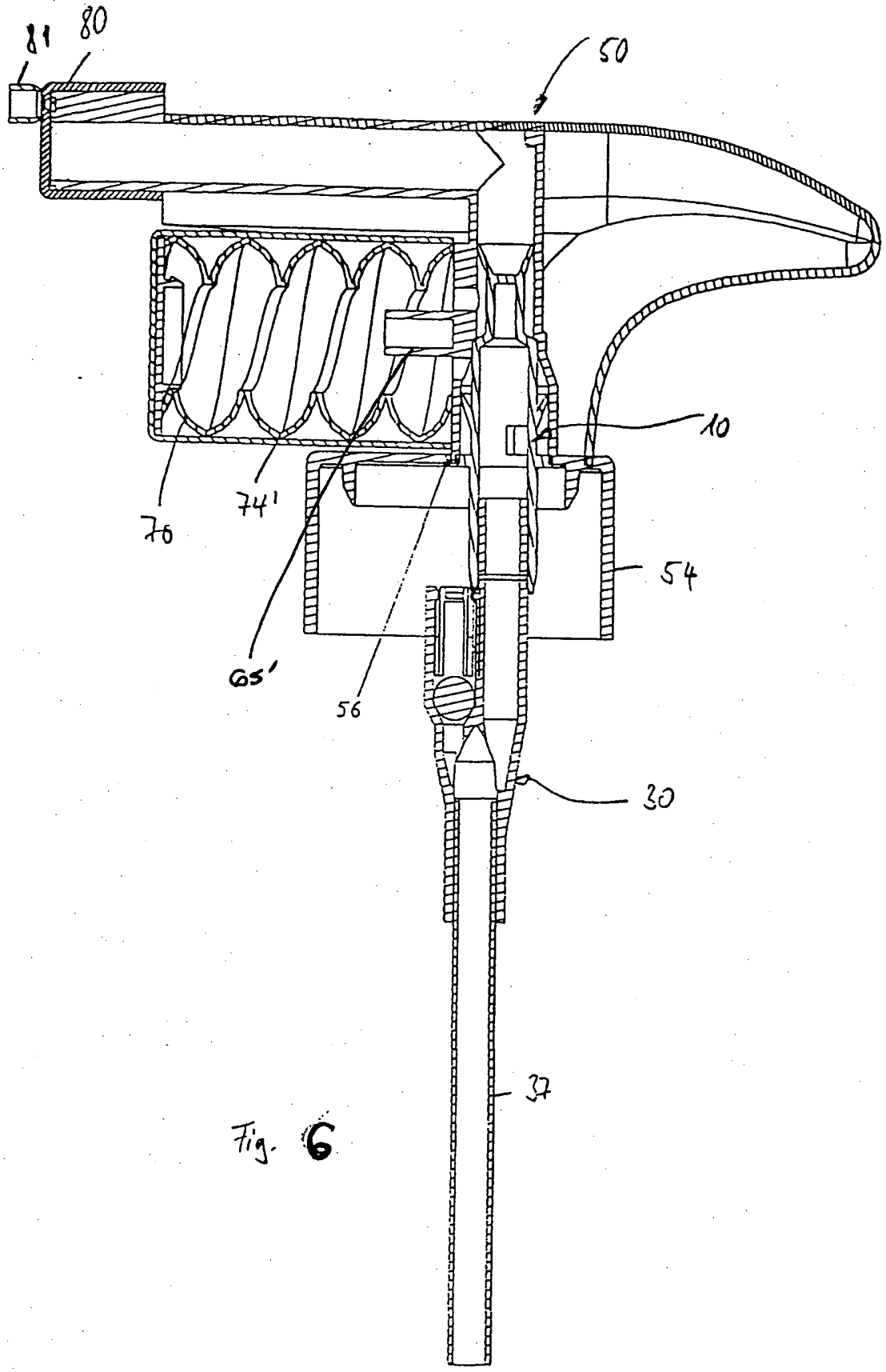

Fig. 6

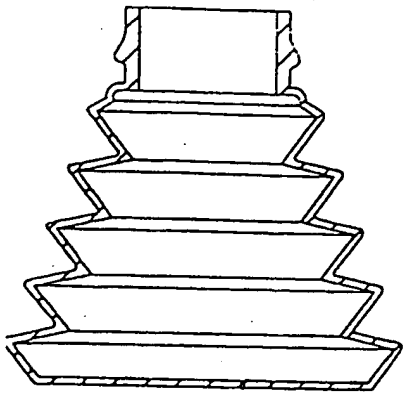

Fig. 7

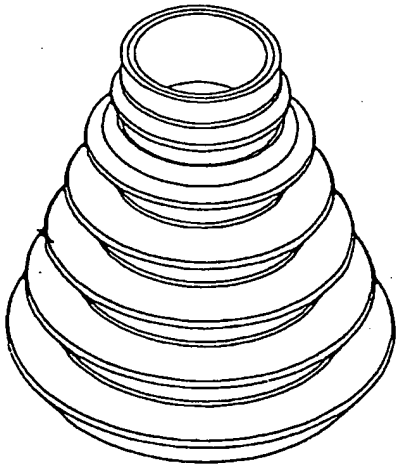

Fig. 8

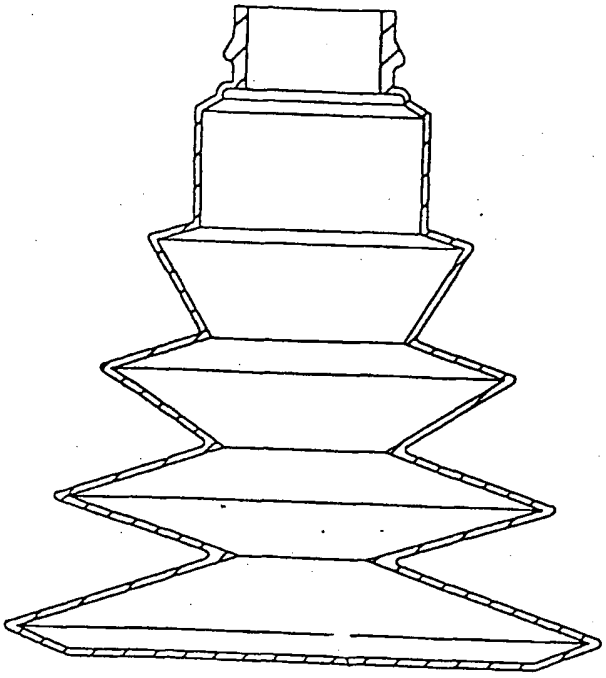

Fig. 9

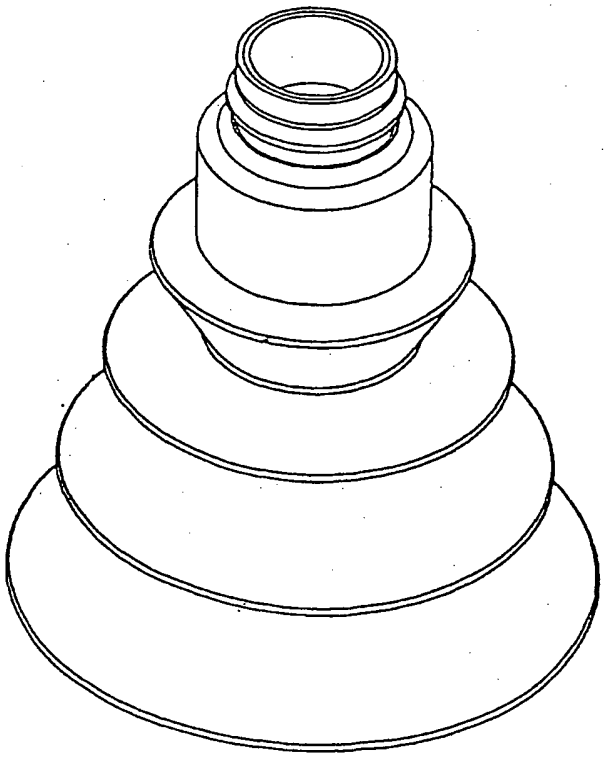

Fig. 10

INTERNATIONAL SEARCH REPORT

Int[illegible]onal Application No
PCT/GB 01/01069

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 651 904 A (SCHUCKMANN ALFRED V) 24 March 1987 (1987-03-24) figure 6	1,3,4
X	US 3 602 387 A (KLEINKE BERNARD L ET AL) 31 August 1971 (1971-08-31) the whole document	1,2
X	US 3 494 512 A (HAYNES RICHARD H) 10 February 1970 (1970-02-10) the whole document	1,3,5
X	US 5 894 960 A (REEVE RANDY F ET AL) 20 April 1999 (1999-04-20) figure 10	1,3,6

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 July 2001	16/07/2001

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